



Profile Analysis of Faculty-Researchers in STEM Education in a Philippine University

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Abstract. *The aim of this study is to explore the individual backgrounds of higher education educators who are involved in research on Science, Technology, Engineering, and Mathematics (STEM) in a state university in the Philippines. To meet this objective, the study used a quantitative research design utilizing descriptive analytical tools. The participants were 104 teachers from campuses that offers STEM undergraduate programs. The study concludes that the university has a gender-neutral participation in terms of doing research. The profile creates an image that doing research in the university is not prejudicial to teachers with lower academic ranks. Meanwhile, the STEM educators have started doing research after some years of teaching and teachers spend half of their academic experience in doing research. On another note, majority of the respondents had more teaching loads than doing research and had less than four years of research experience on average. Based on these findings, for a university aiming to build a strong research culture, it is recommended to apportion more work time for conducting research in addition to teaching and strengthen the university research support to the teachers by providing them opportunities to participate in research conferences, publish researches, and conduct research in the university.*

Keywords: *Faculty-researchers, STEM Education, Research Culture*

INTRODUCTION

In the Philippines, faculty members are usually working on multi-dimensional roles, consisting of teaching, research, and community service/extension; thus, university faculty members are required to become teachers, researchers, and service-oriented professionals. In other words, the strategic career directions of the faculty members are influenced by these roles. In the attempt of describing the role of university teachers, Boyer (1990) defined four fields of the academic profession: the scholarships of discovery, integration, application, and teaching. The scholarship of teaching is to ‘study teaching models and practices to achieve optimal learning’. This can

be done, among other things, through developing and testing instructional materials and through advancing learning theory using classroom research. It is interesting that Since Boyer’s report was published, as observed by Tight (2016) the scholarship of teaching – now known as the scholarship of teaching and learning – has become a major research interest in the academic community.

In the report (2007) of the then Chairperson of the Commission on Higher Education (CHED), Dr. Patricia B. Licuanan on the state of Philippine Higher Education, she stressed one major role of State Universities and Colleges (SUCs) in the country. SUCs must strive in producing high-level academic research

and knowledge which are practical and of immediate usefulness. This is no longer new to SUCs, in fact, research as a mission of a university always qualify as a component in quality assurance mechanisms for SUCs. However, research as a core activity of HEIs is notoriously being neglected. Bernardo (2003) in his study on the typology of HEIs in the Philippines, only 15 out of 223 HEIs in the sample met the requirements for the graduate-capable HEI category. This observation is supported by a 2016 report on academic research in the Philippines where the country placed 5th among South East Asian Nations below Vietnam and Indonesia. The Philippines is even way below the UNESCO recommendation on Gross Expenditure on Research and Development (GERD) of 1% of the countries GDP. In 2007, the Philippines GERD was less than 0.2%, Indonesia 0.8%, and Vietnam has 0.5% allocations. These data show that research has not been part of the institutions' history and life.

On the one hand, in the pursuit of building a research culture, HEI administrators and teachers have to understand that the end of research is not research itself. The products and knowledge generated from researches must be utilized for teaching and service. However, tensions exist between universities in both external and internal perspectives on the extent of involvement of teachers and students to research. The Commission on Higher Education has in fact issued a Handbook on Typology, Outcomes-Based Education, and Institutional Sustainability Assessment – a quality assurance tool for universities relative to their typology. This issuance implies a recognition to the struggle for identity of universities across the country. This typology may offer solution to universities, but at the same time, this triggers an increasing expectation on higher education institutions, including the general recognition of their importance for the knowledge society, and the need for the universities to redevelop and rethink their own place in society and consequently their internal organization.

Describing the research culture in a university can take forms in various ways. Several researches have studied on the association of institutional supports and research disposition to the building of research culture in higher education. As stated previously, there are few universities in the country which have established a strong research culture. The present study argues that the individual backgrounds of

the faculty researchers are as important as other variables like research support to examine. As far as available literatures and studies are concerned, there were limited attempts to differentiate teachers' perception on research integration based on profile variables. Hu (2016) managed to differentiate teachers and their perception on the role of research based on length of research experience and the nature of the university where the faculty members are teaching.

On similar note, teachers' backgrounds have been correlated to several academic variables. Several studies in basic education have shown that determinate teacher characteristics such as advanced degrees, certification, and standardized tests are related to student achievement (Aaronson, Barrow, & Sander, 2007), no studies however with solid statistical treatments have explored teacher efficiency in adult education. The demographic profile of teachers have been shown to be crucial too according to the study of Ehrenberg and his team (1995). They explained that the comparative success of teachers who belong in the minority has been conducted primarily by sociologists, psychologists, and educational researchers and has focused on teachers' attitudes toward, expectations for, and placement of minority students, as well as the feedback that they provide to the students. However, these studies have failed to control for other teacher characteristics, such as verbal ability, experience, and degree levels.

The importance of sex is also highlighted in this study. With the emphasis by the government on gender equality in all services it offers, examining gender data about STEM teachers is just but necessary. In the 90's, the dearth of female mathematics and science teachers is very noticeable. Women are underrepresented in many mathematics, science, and engineering fields at the collegiate level, both as students and as faculty (Ehrenberg, 1992). In the Philippines, a major reason for this underrepresentation is the relatively few enrolments of the female sex in STEM courses. In fact, just two in seven engineering students are female, only 41 percent of students taking IT-related courses are women, and women make up only 43 percent of STEM enrollments—and mostly in non-engineering or non-IT fields, according to the statistics from the Commission on Higher Education (Dominguez-Yujuico, 2019). Also, many cite the absence of female role models in science and mathematics as part of the

explanation for this outcome and call for increased efforts to recruit and retain female high school mathematics and science teachers. However, this is not the case based on the statement of Bernstein (2017). She concluded that women account for 38% to 49% of researchers in 11 of the 12 countries and regions studied. This report was based on Scopus records from 2011 to 2015.

With respect to academic rank and other variables, Salom (2013) investigated the relationship of academic rank to research capability of faculty members in a state university in the Northern Philippines. Salom was able to compute a coefficient value in the identified variables less than their tabular value at .05 level of significance. Therefore, the null hypothesis, which stated that the research capability of the faculty is not affected by the academic rank and other profile variables was rejected. He concluded that research capability of the faculty members was indeed affected by their academic rank, highest educational attainment, and teaching loads.

Therefore, this paper attempts to interweave the profile of the faculty-researchers in STEM education to aid on describing the research culture in the university by identifying the demographic, educational, teaching and research experience of the STEM educators.

METHOD

This study is guided by a quantitative research design. Specifically, this study employed the descriptive method to carry out **Table 1**. Data respondents in this study

Campus	Number of Researchers (STEM)	Number of Respondents	Response Rate
Andrews	28	22	78.57%
Aparri	17	14	82.35%
Carig	41	34	82.93%
Piat	19	16	84.21%
Sanchez Mira	26	18	69.23%
Total	131	104	79.39%

With regard the response rate in this study, when Johnson & Owens (2003) surveyed the editors of 18 prominent social science journals, they found that, of the ten editors who participated in the study, three editors' journals had published policies regarding the reporting of survey response rates. They did report that despite the absence of a formal policy, the journal did expect "at least a 60% response rate with rare

successfully the objectives stated in this dissertation. A survey was conducted by the researcher to gather pertinent data and were treated using descriptive and inferential statistics. According to Scheuren (2004), a survey is a general view, examination, or description of people's attitudes, impressions, opinions, expectations, beliefs, and behaviors on specific facts.

Cagayan State University was the locale of this study. The research area is reduced to the campuses of Carig, Andrews, Piat, Aparri and Sanchez Mira. The said campuses are the biggest in numbers in terms of faculty and student population. Since the subjects of exploration are the teachers in STEM programs, only colleges offering STEM courses were considered. Carig offers courses on engineering, technology, and pure sciences. Andrews campus, meanwhile, offers allied health courses and science and mathematics teaching. Piat offers agriculture courses and Aparri and Sanchez Mira offers fishery courses. These campuses, all in all, is believed to suffice to make the data valid and reliable.

There was a total of 104 respondents in this study selected on the basis of these criteria: *a*. Teaching subjects along Science, Technology, Engineering, and Mathematics; and *b*. Have been doing research or those who have done researches. The data about the researchers in the university, their number and campus were sourced from the office of the Vice President for Research for Development and Extension.

exceptions." Several editors noted that they make such judgments on a case-by-case basis. Based on the aforementioned parameters on response rate in surveys, the research believes that a 79.39% response rate is an acceptable figure.

As a protocol to data analysis, prior to the conduct of the formal analysis, normality and linearity of data were checked. Mean and percentage were used to describe the profile of the respondents. A scatter-plot diagram was used

for some of the variables to add nuance in the data.

RESULTS AND DISCUSSION

Results

Among 104 respondents surveyed in this study, Table 2 shows an equal percentage of male (50%) and female (50%) faculty-researchers.

Table 2. Profile of the respondents in terms of Sex

	Frequency	Percent
Male	52	50.0
Female	52	50.0
Total	104	100.0

Meanwhile, Table 3 presents the frequency distribution of the respondents based on their academic rank. It can be deemed from the table that majority of the faculty-researchers are holders of Instructor positions (53.8%) and only 3.8% or four of the respondents are professors.

Table 3. Profile of the respondents in terms of Academic Rank

	Frequency	Percent
Instructor	56	53.8
Assistant Professor	24	23.1
Associate Professor	20	19.2
Professor	4	3.8
Total	104	100.0

As mentioned in the research methodology of this research, five campuses were selected on the basis of the population of faculty members and presence of STEM undergraduate programs. Table 4 indicates

disaggregated data based on campus and college where the faculty belongs. Majority of the respondents are from Carig Campus (32.7%) followed by Andrews Campus (21.2%) and Sanchez Mira Campus (17.3%).

Table 4. Profile of the respondents in terms of Campus and College

Campus	Frequency	Percent
Andrews	22	21.2
Aparri	14	13.5
Carig	34	32.7
Piat	16	15.4
Sanchez Mira	18	17.3
Total	104	100.0
College	Frequency	Percent
College of Agriculture	16	15.4
College of Engineering	16	15.4
College of Allied Health Sciences	19	18.3
College of Arts and Sciences	6	5.8
College of Fisheries and Marine Science	5	4.8
College of Information and Computing Science	21	20.2
College of Industrial Technology	8	7.7
College of Teacher Education	9	8.7
College of Veterinary Medicine	4	3.8
Total	104	100.0

Table 5 presents the frequency distribution on educational attainment of the respondents. It is shown in the table that more

than half of the total respondents (59.6%) are holders of master's degree. Whereas about 40

percent of the respondents are undergraduates and doctorate degree holders.

Table 5. Profile of the respondents in terms of Educational Attainment

	Frequency	Percent
Bachelors	9	8.7
Masters	62	59.6
Doctorate	33	31.7
Total	104	100.0

A crucial variable in this study is the length of experience in teaching and research of the faculty members. Generally, the average length of doing research by the faculty members

surveyed are significantly lesser than the number of years they have been teaching. Table 6 below shows the results.

Table 6. Length of Teaching and Research Experience (in years)

	Minimum	Maximum	Mean	Std. Deviation
Teaching Experience	1.00	38.00	11.37	9.15
Research Experience	1.00	15.00	3.92	3.52

Table 7 reveals the workload of the respondents. When the respondents were asked if which is more dominant in their workload- either

research or teaching. A negligible 4.8% answered that there is more research in their workload than teaching.

Table 7. Status of Workload of the Respondents

	Frequency	Percent
More Teaching-Less Research	99	95.2
More Research-Less Teaching	5	4.8
Total	104	100.0

Discussion

Though the researcher wasn't able to retrieve all questionnaires, the researcher found a very interesting inference from the data on sex of the respondents. The equal number of male and female STEM faculty researchers in the university tells something about the participation of both sexes in the academe particularly in research activities. Now that gender and development (GAD) is integrated in almost all activities in the university, this finding would imply that in STEM teaching and research, both male and female faculty members in the university are contributory. Moreover, the data can be explained by the nature of professions of the faculty members surveyed. Further examination of the data would tell that a considerable number of respondents have

bachelor's degrees which are taken dominantly by male (e.g. engineering, information technology, industrial technology) but there are also degrees which are dominantly female (e.g. education, health sciences). The increasing participation of women in STEM teaching is supported by the statement of Bernstein (2017). She concluded that women account for 38% to 49% of researchers in 11 of the 12 countries and regions she studied. This report was based on Scopus records from 2011 to 2015.

Meanwhile, Table 3 presents the frequency distribution of the respondents based on their academic rank. It can be deemed from the table that majority of the faculty-researchers are holders of Instructor positions (53.8%) and only 3.8% or four of the respondents are professors. These data mirror the proportion of instructors and other academic ranks of the entire population

of faculty members in the university. Data from the office of the instruction director reveals that majority of the teaching positions in the university are instructors. This has been brought about by the massive influx of permanent instructor positions in 2017. The number of professors against the total population remains to be small.

This data poses two implications; **a)** Although the existing research and extension manual of the university does not mandate instructors and assistant professors to involve themselves in research, there is still a large participation of these faculty members as far as STEM teachers are concerned; and **b)** The university mandates research works for associate professors (30%) and professors (50%). This proportion of research involvement of these ranks is considerably impressive at least for STEM teachers.

As mentioned in the research methodology of this research, five campuses were selected on the basis of the population of faculty members and presence of STEM undergraduate programs. Table 4 indicates disaggregated data based on campus and college where the faculty belongs. Majority of the respondents are from Carig Campus (32.7%) followed by Andrews Campus (21.2%) and Sanchez Mira Campus (17.3%). It must be noted that Carig Campus houses the greatest number of faculty members including several STEM undergraduate programs like engineering, industrial technology, and information technology. Meanwhile, Andrews campus houses the allied health sciences and STEM Education programs and Sanchez Mira is the home of agricultural engineering, industrial technology, and STEM Education programs. On the other hand, majority of the respondents are lodged in the College of Information and Computing Sciences (20.2%) followed by Allied Health Sciences (18.3%), Engineering (15.4%) and Agriculture (15.4%).

Table 5 presents the frequency distribution on educational attainment of the respondents. It is shown in the table that more than half of the total respondents (59.6%) are holders of master's degree. Whereas about 40 percent of the respondents are undergraduates and doctorate degree holders. In higher education, the minimum requirement for a teaching position is a master's degree. This policy explains why most of the respondents are master's degree holders. It can also be inferred

from the data that those who holds college degrees may have been given a temporary permanent position. Moreover, we have seen that in Table 2, a quarter of the respondents are associate professors and professors. This cohorts the number of doctorate degree holders surveyed. A PhD is required for holders of professorial ranks while this adds considerable number of points for those who aspire for associate professorial ranks. A crucial variable in this study is the length of experience in teaching and research of the faculty members. Generally, the average length of doing research by the faculty members surveyed are significantly lesser than the number of years they have been teaching. This relatively short experience of doing research ($x=3.92$) speaks of the "*hibernation*" of the university in involving faculty members in the generation of new knowledge and technologies. It must be noted that the university had a long period in its history when accreditation was not a priority and therefore halted the development of research endeavors. Only in the recent five to six years that the university underwent serious quality assurance systems and that necessitates a number of research activities where faculty members are involved. In fact, there are several research projects, programs, and centers that are under way and were completed during the recent years. On another note, the average teaching experience of the 104 respondents is 11.37 years.

To add more nuance in the previous data. A graph of teaching experience against research experience is shown in Figure 1. There can be several inferences from the graph. In general; **a)** the faculty members started doing research after some years of teaching; looking closely, **b)** the graph implies that on average, teachers spend half of their academic experience in doing research; and **c)** there were few deviations from the *best fitting line*- either teachers who have spent extremely shorter and considerably longer years in doing research against their length of experience in teaching.

The first inference can be explained by a research finding cited by Vecaldo et.al (2019). In the context of beginning teachers such that of the instructors, Gray and Campbel-Evans (2002) investigated the beginning teachers' perceptions of their empowerment and development as researchers. Findings suggest that beginning teachers have not yet overcome the hurdles of being a teacher, moreover as teacher-researchers. The researchers recommended that teacher-training institutions must initiate the concept of

teacher as the researcher and must be an on-going process.

Meanwhile, the last table presents a striking but somehow expected revelation. When the respondents were asked if which is more dominant in their workload- either research or teaching. A negligible 4.8% answered that there is more research in their workload than teaching. Tracing the origin of this data, the respondents who answered are professors and associate professors. As far as the researcher can remember, some of these faculty members are also designated officials. Their equivalent teaching load (ETL) brought about by their designations could have refrained them from taking teaching units and just integrate their ETLs for research. Meanwhile, majority (95.2%) of the respondents have lesser research units than teaching. This corresponds to the profile of the respondents on academic ranks. It was mentioned that for instructors and assistant professors, doing research is optional while 30% of the regular workload of associate professors is intended for research.

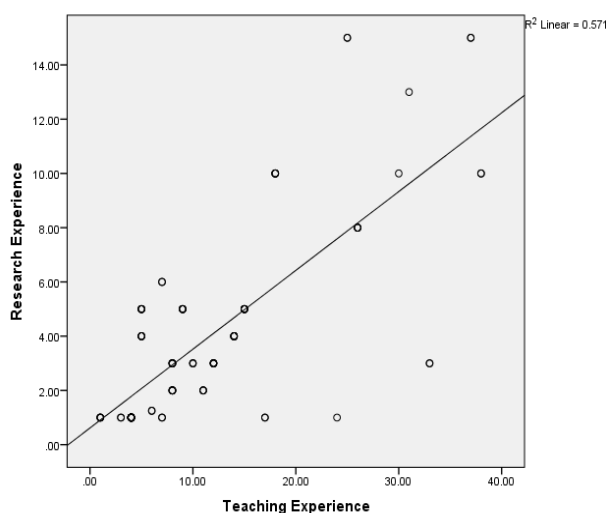


Figure 1. Scatter-dot diagram of Research Experience against Teaching Experience

CONCLUSIONS AND SUGGESTIONS

Generally, the profile of the respondents speaks of a gender-neutral participation in terms of doing research. The profile further creates an image that doing research in the university is not prejudicial to teachers with lower academic ranks. The STEM educators started doing research after some years of teaching and on

average, teachers spend half of their academic experience in doing research.

As shown, almost all of the respondents had more teaching loads than doing research and had less than four years of research experience on average. Thus for this particular group of teachers, four suggestions can be followed to bridge the gap between the ideal and the actual for the integration of research into teaching: a) Apportion more work time for conducting research in addition to teaching; b) Increase the amount of research experience; c) Boost research training; and d) Needless to say, the university must strengthen its research support to the faculty members by providing them opportunities to participate in research conferences, publish research outputs, and conduct research in the university.

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